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Compositæ, detected by Mr. Charles Wright in the Eastern Part of Cuba.

II. On the Genus *Croomia*, and its place in the Natural System.

Four hundred and sixty-fifth meeting.

April 26, 1859. — SUPPLEMENTARY MEETING.

In the absence of the President and Vice-President, the Corresponding Secretary took the chair.

The Corresponding Secretary read a letter from the Asiatic Society, dated Calcutta, December 10, 1858, acknowledging the receipt of the Academy's publications.

Professor Peirce gave the following analysis of his memoir upon the Tail of Donati's Comet.

"1. The theory proposed by Bessel, in Vol. XIII. of the *Astronomische Nachrichten*, is adopted as the basis of the theory, and it is proposed to determine the special values of the repulsive force from the sun, and of the initial impulse given by the comet, which are most reconcilable to the observed phenomena. In the first approximation, the initial impulse was neglected, because it was assumed to be quite small.

"2. Rigorous formulæ are adopted in place of the approximations given by Bessel, which are only available at a short distance from the head of the comet, whereas the critical portions of the investigation are those which apply to the part of the tail which is most remote from the head. The approximate formulæ were employed by Pape in his researches upon Donati's comet, which is astronomically designated as 1858 V.

"3. The observations of the tail which have served as the basis to this investigation are those given by Pape in the *Astronomische Nachrichten*, and an admirable series made at the Dudley Observatory, by Mr. Searle and Mr. Toomer, under the judicious direction of Dr. Gould.

"4. The observations of the front edge of the Donati comet are very well satisfied by a solar repulsive force $= -1\frac{1}{2}$, if gravity is adopted as the unit of force. The comparison of theory with observation was illustrated by diagrams, in which the observations were all combined into three tails, which may be designated as *normal tails*, and of which the dates were respectively the second, the ninth, and the fifteenth of October.

"5. An attempt was next made to satisfy the observations by a sensible initial velocity arising from the action of the comet's nucleus, and in which there should be neither repulsive nor attractive force exerted upon the particles of the tail. But it was found impossible to accomplish this result.

"6. It was found equally impossible to satisfy the observations by Pape's theory, in which the solar force is supposed to be attractive, or slightly repulsive; and the difference between this result and that obtained by Pape must be attributed to the defects of the approximative formulæ employed by Pape. It may otherwise be regarded as objectionable to Pape's theory, that it assumes the solar force to be so variable in its action, and the initial velocity arising from the action of the comet's head to be so large.

"7. In the present theory, however, the solar force is not found to be constant for all the particles of the tail, but to vary from the extreme repulsion $= -1\frac{1}{2}$ down to zero, or even to be attractive for the particles upon the back edge. But the back edge is so badly defined, that the observations upon it cannot contribute much to the accuracy of these investigations.

"8. The streaks of light, which were observed about the time of greatest brilliancy, towards the extremity of the tail, are probably to be attributed to the continuous discharge of material from different points of the nucleus. It was an amusing and juvenile play of fancy which saw in this phenomenon indications of concentration into new comets.

"9. The suggestion that the dark line in the tail, near the head, may be shadow, is quite absurd. The shadow of so small a nucleus could not have been in the least degree perceptible to us, and the accurate measures which were taken, as they should have been, by the most competent observers, show that the direction of this dark line sensibly deviated from that of the radius-vector from the sun, which must have been the direction of a shadow. A *diverging* shadow in this case is too preposterous for argument. The darkness can only be explained by an actual deficiency of the matter of the tail, and corroborates the inference from the form of the tail, that the matter is not ejected from the head with any great velocity, but that it passes off before and behind, so as to be but little expanded in a direction perpendicular to the plane of the orbit.

"10. The successive envelopes ascend uniformly towards the sun, at the rate of about thirty-five miles an hour.

"11. This law of ascent is peculiarly consistent with that of a vapor in an atmosphere. The appearance of the envelope of Halley's comet in 1835, as described by Herschel, was also that of a fine vapor.

"12. The uniformity of the law of ascent is irreconcilable with the hypothesis of a mass rising in a free space under the combined action of accelerating and retarding forces, which emanate from the comet and the sun. The continuance of the ascent by the same law, during the approach to perihelion and the removal from it, is opposed to the ingenious explanation of Herschel, which attributes the apparent increase of magnitude, when the comet recedes from the sun, to the deposit of vapor as the comet cools. The phenomena exhibited by other comets seem to confirm these views.

"13. The great extent of atmosphere which this theory, or that of Herschel, requires the comet to possess, involves the necessity of a much greater mass of the comet than is usually supposed, although the mass will not exceed the limits adopted by Laplace in the case of Lexell's comet. While, on the other hand, the small volume of the nucleus into which this mass is chiefly concentrated will give a density to some of the comets which will exceed that of the planets, and even be metallic in its nature. With such a mass and density, the blow of a comet might be quite disastrous to the inhabitants of a planet. The metallic density of the two comets of 1680 and 1843, which approached so near the sun, seems to be a necessary condition for the preservation of their internal continuity and coherence, when they are melted by the great heat of the sun. This metallic character of the comet is analogous to that of meteoric stone.

"14. The nearly spherical outlines of the envelope are simply results of uniform ascent of a vapor; but they differ sensibly from the level surfaces which would be given either by the theory of Roche or by that of Herschel.

"15. After a careful examination of the observations of the head of the comet, Pape did not find any established law of vibration, like that which Bessel demonstrated in the Halley comet of 1835. But from a new examination, upon a different basis, it appears that there was such a vibration, that each new envelope had its own initial period of vibration, that there was one common law of vibration, and that the vibration continued as long as the envelope was near the nucleus. The phenomena seemed to be those which would be exhibited if the nucleus were in a state of magnetic oscillation, as suggested by Bessel, or if it were rotating about an axis pointed towards the sun, and if each envelope were projected from a different point of the comet's surface.

"16. The phenomenon attributed to the resisting medium would be fully as accurately explained in the mode suggested by Herschel. The loss of the repelled matter must involve an apparent augmentation of the weight of the attracted portion without that corresponding increase of velocity which is required to preserve the mean distance and time of revolution. Thus, in the equation

$$\frac{v^2}{\mu} = \frac{2}{r} - \frac{1}{a},$$

the increase of the denominator of the first member is analytically the same with the decrease of the numerator; or, physically, to increase the gravity is the same as to decrease the velocity. The apparent resistance, in the case of Encke's comet, might be accounted for by a loss of about $\frac{1}{30000}$ of its mass at each return. But even without the loss of mass, an approach to the same phenomenon would result from the mere separation of the polar forces of the comet under the solar influence, which would draw one portion towards the sunny side of the comet, and drive the repelled force to the opposite side.

"17. The driving off the tail would tend to give rotation to the comet, or rather to return to the comet as rotation part of the force which had been taken out as translation. The opposite phenomenon might be exhibited in the case of a planet, on account of its rotation being in the same direction with the revolution of the planet about the sun. It is possible that this may account for the decrease of mean motion, which is indicated, with some uncertainty, by Leverrier's profound investigations of the planet Mercury, so that there may be exhibited a transformation of rotation into translation.

"18. The formation of the comet's tail is not without analogy in the terrestrial phenomenon of the thunder-cloud. Here, at least, is exhibited the phenomenon of a vapor rising in an electrified condition, under the action of the sun. Were the earth to be carried near enough to the sun, the clouds which were properly electrified would be repelled, and might be driven off to form a terrestrial tail. It may be, indeed, that the Aurora Borealis is the exhibition of such a phenomenon."

Remarks were made on Professor Peirce's communication by Professor G. P. Bond and Professor W. B. Rogers.

Dr. B. A Gould referred to the recent decease of Manuel J. Johnson, Director of the Radcliffe Observatory of Oxford, and introduced the following resolutions.

"Whereas, by a recent afflicting dispensation of Providence, Manuel John Johnson, Director of the Radcliffe Observatory of Oxford, has been suddenly removed from the field of his useful labors, and the Academy deprived of one of its bright and valued ornaments, —

"*Resolved*, That the Academy has heard with pain the sad announcement of this severe bereavement, lamenting the heavy loss which Science has sustained by the removal of one of her most successful and devoted ministers.

"*Resolved*, That the sympathies of the Academy be offered to the family of the deceased astronomer, together with the assurance that the name, example, and character of their departed husband and father will long serve as an incentive and example to those who aim at progress in the high calling which he adorned."

On motion of Professor Peirce, the resolutions were unanimously adopted.

Four hundred and sixty-sixth meeting.

May 10, 1859. — MONTHLY MEETING.

The Academy met at the house of the Hon. Nathan Appleton.

The PRESIDENT in the chair.

The Corresponding Secretary read a letter from the Secretary of the American Antiquarian Society, dated April 27, 1859, communicating the thanks of the Society for the use of the Academy's hall.